RESEARCH NOTES

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

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CHEMICAL CONTROL OF THE FIR ENGRAVER

by

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The fir engraver, Scolytus ventralis Lec., one of the important bark beetles, has been in epidemic status since 1949 on approximately 6,000 acres in the white fir stands of the Sandia Mountains recreational area east of Albuquerque, New Mexico. Cumulative tree mortality ranges from 20 to 80 percent. The most serious losses occurred in the La Madera ski development. The epidemic is believed to have resulted from an increase of engraver populations in felled trees and slash on about 400 acres cleared in 1948 for the development of the ski area. Trees weakened by a heavy spruce budworm infestation and severe drought may have also contributed to the epidemic. Beetle populations increased still more in trees that were blown over during the spring of 1950.

The high recreational value of the Sandias depends on a heavy timber cover for snow deposition in winter and cool shade in the summer. The importance of preserving the remaining white fir is apparent. Salvage logging and the chemical control of beetles in culls and in trees not accessible to logging operations seemed to be one possible solution to the problem.

LABORATORY TESTS AND RESULTS

An effective ethylene dibromide formulation had just been developed for use against the Engelmann spruce beetle in Colorado.[2] The logical step in developing a chemical treatment for fir engraver control, therefore, was the evaluation of several concentrations of ethylene dibromide in fuel oil. Accordingly, tests were conducted on 36 small bolts of infested white fir brought to the Fort Collins Laboratory in April 1952 and on standing white fir in the La Madera ski area during June 1952.

1/ Fred B. Knight assisted with the analysis of variance.

2/ Massey, C. L., and Wygant, N. D. Biology and Control of the Engelmann Spruce Beetle in Colorado. U. S. Dept. Agr., Cir. 944, 35 pp., illus. July 1954.

Bolts used in the laboratory tests were 12 to 16 inches in diameter, 18 inches long, and contained a rather uniform infestation of fir engraver larvae. During application of the chemical, each bolt was rotated within a spray chamber on a turntable while the ethylene dibromide solutions were applied from a nozzle that delivered a fan-shaped stream. Solution dosages were computed on the basis of 50 milliliters per square-foot of bark surface. This was sufficient to produce runoff, the criteria used in field applications to indicate adequate coverage. During the third week after treatment, the bolts were systematically sampled for larval mortality. Percentage mortality for each bolt was based on counts from 4 bark samples 6 by 6 inches square. One sample was taken from each quadrant, at least 5 inches from the ends of the bolt. Bark near the ends tends to lose moisture more readily in spite of the use of hot paraffin dips.

At the time the ethylene dibromide evaluations were being made, a commercial grade of orthodichlorobenzene was tested to determine if it also might prove effective against the engraver.

Pertinent data and percentages of larval mortality obtained from the tests are summarized in table 1.

Table 1.--Mortality of fir engraver larvae in white fir bolts treated with oil solutions of ethylene dibromide and orthodichlorobenzene. Fort Collins Laboratory, April 18, 1952.

Treatment[1/]	Tests	Dead larvae	Mortality[2/]
	No.	No.	Percent
Ethylene dibromide			
0.5	6	689	85.0
1.0	6	492	93.0
2.0	6	501	97.5
Orthodichlorobenzene			
6.0	6	470	89.9
8.0	6	685	95.3
Check (no treatment)	6	11	1.8

1/ Figures indicate pounds of commercial grade chemicals in fuel oil to make 5 gallons of oil solution.

2/ Critical differences between percent mortalities at the 95 percent level equals 10.2 percent. Ethylene dibromide at 2.0-pound dosage produces significantly greater mortality than at 0.5-pound.

FIELD TESTS AND RESULTS

Field tests were made with 12 infested white fir trees near the La Madera ski tow on June 7, 1952. Six were treated with ethylene dibromide solution at the 1-pound per 5-gallon rate, and 6, at the 2-pound rate. At the time of treating, 10 trees were examined for brood status by removing small chips of bark. Samples from 1 tree contained pupae and larvae; those from 2 trees, only pupae; and those from 7 trees, only larvae. When the mortality counts were made on June 23 and 24, all stages of the beetle were found in samples from untreated trees. Procedure for sampling mortality was the same as that described for the laboratory study. The data are summarized in table 2.

Table 2.--Mortality of fir engraver larvae and pupae in standing white firs treated with oil solutions of ethylene dibromide. La Madera Ski Area, June 7, 1952.

Treatment 1/	Trees	Dead larvae and pupae	Mortality
	No.	No.	Percent
Ethylene dibromide			
1.0	6	301	96.8
2.0	6	454	95.6
Check (no treatment)	1	4	5.1

1/ Figures indicate pounds of commercial grade chemical in fuel oil to make 5 gallons of oil solution.

Brood conditions were examined in only two untreated white firs. All larvae found in one of these trees were dead. Larvae tunnels were normal, but all contained many small mites, together with a few unidentified insectivorous larvae. Data from this tree are not included in the table.

SUMMARY

Tests indicate that larval, pupal, and adult stages of the fir engraver are highly vulnerable to solutions of 1 and 2 pounds of ethylene dibromide in 5 gallons of fuel oil and to 8 pounds of commercial grade orthodichlorobenzene in 5 gallons of fuel oil. Variation in the results of the laboratory tests exceeded expectation; the 6 replications at the 1-pound dosage were insufficient to indicate whether the results differed significantly from those for the 2-pound concentration.

Control of the fir engraver is generally considered to be impractical because the attacked trees are scattered, and the initial attacks on the trees may be too high from the ground to be readily detected. In some instances, however, such as in the Sandia Mountains, severe outbreaks have been characterized by rather heavy and complete infestation of the boles of the attacked trees in a single season. Under such conditions, chemical treatment may be effective in reducing beetle populations to protect the remaining stand.

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